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ABSTRACT

Theories of school learning consistently point to variables such as ability, time (e.g., homework), quality of instruction, motivation, and academic coursework as important influences on learning. In this study, path analysis was used to test the direct and indirect effects of these variables on high school learning, with learning measured by both achievement test scores and high school grades. Relevant background characteristics were controlled and a longitudinal sample was used. The sample consisted of 25,875 high school students selected from the base year (1980) and the first follow-up (1982) of the Department of Education's High School and Beyond Longitudinal Study. Subjects were in 10th grade in 1980 and in 12th grade in 1982. The results suggest that ability, academic coursework, and homework all have important direct effects on achievement test scores, whereas the effects of quality of instruction and motivation were primarily indirect, chiefly through coursework and homework. When grades were used as the criterion, each of the potentially manipulable variables of interest, with the exception of homework, had a stronger effect relative to that of intellectual ability. Homework, however, had only inconsistent effects. The results offer support for these variables as important influences on school learning, and also support their inclusion in theories of school learning. (Author/NB)

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Testing Theories of Learning: Effects on High School Achievement

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Presentation at the American Psychological Association Convention, Atlanta GA, August 15, 1988. The research reported here was conducted while the senior author was Senior Research Fellow, Office of Educational Research and Improvement, U.S. Department of Education. The views expressed are ours and do not neccessarily reflect the position or policy of OERI. Correspondence should be sent to Timothy Z. Keith, 206 UCOB, Virginia Tech, Blacksburg, VA 24061 (Bitnet ID: TZKEITH at VTVM1).

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Abstract

Theories of school learning consistently point to variables such as ability, time (e.g., homework), quality of instruction, motivation, and academic coursework as important influences on learning. Here, path analysis was used to test the direct and indirect effects these variables on high school learning, with learning measured by both achievement test scores and high school grades. Relevant background characteristics were controlled, and a longitudinal sample used. Results suggest that ability, academic coursework, and homework all have important direct effects on achievement test scores, whereas the effects of quality of instruction and motivation are primarily indirect, chiefly through coursework and homework. When grades were used as the criterion, each of the potentially manipulable variables of interest, with the exception of homework, had a stronger effect relative to that of intellectual ability. Homework, however, had only inconsistent effects. Results offer support for these variables as important influences on school learning, and also support their inclusion in theories of school learning.

Testing Theories of Learning: Effects on High School Achievement

Statement of the Problem

Continued concern about the quality of American education highlights the need to understand the important influences on school learning. Theories of school learning (e.g., Carroll, 1963; Walberg, 1981; Wiley & Harnischfeger, 1974), would seem to offer little help in this search because they appear to focus on different aspects of learning. Walberg, for example, discusses "educational productivity", whereas Carroll focuses on "time needed to learn" versus "time spent learning." Despite surface inconsistencies, a closer examination of these various theories reveals consistencies among them. All, for example, acknowledge the importance of intellectual ability; Carroll (1963) and Wiley (1984) include an aptitude component within the category of time needed to learn, and Walberg (1981) discusses ability as a component of aptitude.

In fact, theories of school learning generally have focused on background influences (e.g., family background characteristics and intellectual ability or aptitude), instructional variables (quality and quantity of

coursework), time variables (time engaged in academic coursework, time spent on homework), and academic motivation. It is particularly noteworthy that many of these influences are potentially manipulable; the theories therefore have implications both for changes in education in general and for specific educational interventions.

Research has also supported the importance of these and related variables in their impact on learning (cf. U.S. Department of Education, 1986; Walberg, 1984; Walberg, Schiller, & Haertel, 1979), although such support is far from consistent. Still, few researchers (with the exception of Walberg and his colleagues) have included more than one or two such influences simultaneously in their analyses so that each variable could compete with the other variables. There is considerable evidence that homework influences learning and achievement (e.g., Keith, 1982), for example, yet there is also evidence that these apparent effects may disappear when more complex analyses, incorporating additional variables, are used (e.g., Walberg & Shanahan, 1983). Even fewer researchers have focused on both the direct and indirect effects of these variables on learning, although indirect effects are quite likely. For example, motivation may have larger indirect than direct effects on school achievement; highly motivated

students complete more academic coursework, and this coursework, in turn, seems to affect their achievement (Cool & Keith, 1988).

The purpose of the present study was to determine the extent of the direct and indirect effects of intellectual ability, quality of instruction, academic motivation, quantity of academic coursework, and time spent on homework on high school students' achievement, with achievement measured by both achievement test scores and grades.

Subjects

Data from a large sample of high school sophomores were analyzed. The sample consisted of 25,875 students selected from the base year (1980) and first follow-up (1982) of the Department of Education's High School and Beyond Longitudinal Study (HSB). The subjects were high school sophomores in 1980 and seniors in 1982. The following variables, all assessed in 1980, were included in the path model: ethnicity (1=white, 0=other), family background (fathers' occupational status, mothers' and fathers' educational attainment, family income, and possessions in the home), gender (1=female, 0=male), intellectual ability (vocabulary standardized test), quality of instruction (students' ratings of the their schools' quality of instruction, repuation in the community,

and teacher interest in students), and academic motivation (interest in school, whether like to work hard in school, and college plans). Variables in the model from the 1982 first follow-up included quantity of academic coursework (Algebra I & II, Geometry, Trigonometry, Calculus, Physics, Chemistry, Biology, Honors English, and Honors Math), homework (average time spent per week), and academic achievement. Two sets of analyses were conducted: In the first, an achievement test score composite (reading, math, civics, writing, science) was used as the criterion of achievement; in the second, high school grade point average was the criterion.

For the analyses using grades as the criterion, the HSB second follow-up (SFU) was used because it incorporates information from students' transcripts. Use of the SFU thus allowed the grades criterion to be a measure of students' high school grade point average computed from their transcripts rather than from student self-report. Although only a subsample of the original sophomore cohort was included in the SFU, there were still 13,152 students available for analysis.

Procedure

Causal path analysis was used to determine the direct and indirect influences of intellectual ability, quality of instruction, academic motivation, quantity

of academic coursework, and homework on high school sophomores' academic achievement while controlling for other, relevant influences. The theoretical models proposed were recursive path models; paths were estimated by the beta weights from multiple regression analysis.

Results

Results suggested that intellectual ability is the single strongest influence on high school students' achievement test scores, but that the amount of academic coursework completed in high school also has a powerful direct effect (see Figure 1). The amount of time students spent doing homework also had a meaningful direct effect (defined as a path > .05). Although neither quality nor motivation had a meaningful direct effect on these students' achievement as high school seniors, both variables affected the amount of time students spent on homework and the amount of academic coursework they took. As a result, motivation had a substantial indirect effect on achievement, and quality had a meaningful effect (direct + indirect; see Table 1).

Insert Figure 1 and Table 1 about here

Additional analyses suggested similar results for diverse subgroups within the total sample. Interestingly,

academic coursework seemed to influence achievement even for low-ability students. The same general pattern of results emerged for all ethnic groups, with some minor differences. Homework was a nonmeaningful influence on the achievement of white and Native American (American Indian and Alaskan native) students, but was particularly powerful for black students. Academic coursework was a particularly powerful influence for students of Asian descent.

When high school grades were used as the criterion, ability had a smaller, although still substantial, effect, and several of the potentially manipulable influences had stronger effects than when test scores were used (Figure 2). Motivation and academic coursework each had a meaningful direct effect on grades, and quality of instruction and motivation both had meaningful indirect effects as well (Table 2). Homework had inconsistent effects: it appeared to have only a small, nonmeaningful effect for the total group, but appeared as an important influence in some of the preliminary subgroup analyses. Those analyses also suggest intriguing differences among groups, and particularly for Asian American students. For those students, coursework appeared a very powerful influence on grades, and motivation and homework were also quite important.

Insert Figure 2 and Table 2 about here

Conclusions

These results provide support for the effects of ability, quality, motivation, academic coursework, and homework as important influences on school learning. Although these and related variables are common among theories of school learning, and although there is support for each, by itself, as an influence on achievement, few researchers have examined the effects of these variables in combination, and fewer still have examined both direct and indirect effects.

Across both sets of analyses, intellectual ability and the amount of academic coursework taken each had an important, direct effect on achievement, with achievement measured both by test scores and by grades in school. Time spent on homework also affected students grades and test scores, although not consistently. Quality of instruction and academic motivation influenced achievement primarily indirectly; students with higher quality of instruction and motivation completed a more academic curriculum and more homework, and, in turn, they achieved at a higher level.

There were some intriguing differences in the results obtained when test scores were used as the achievement criterion in contrast to grades. Ability had a smaller effect on grades, whereas most of the other variables of interest--quality, motivation, and coursework--each had a larger total effect, presumably because grades are more closely attuned to motivation and effort than are test scores. Such results suggest that changes in each of these variables might be expected to have a stronger and more immediate effect on grades than on achievement test scores.

References

Carroll, J. B. (1963). A model for school learning. Teachers College Record, 64, 723-733.

Cool, V. A., & Keith, T. Z. (1988, June). Testing theories of school learning: Direct and indirect effects on academic achievement. Manuscript submitted for publication.

Keith, T. Z. (1982). Time spent on homework and high school grades: A large-sample path analysis. Journal of Educational Psychology, 74, 248-253.

U.S. Department of Education. (1986). What works: Research about teaching and learning. Washington, DC: Author.

Walberg, H. J. (1981). A psychological theory of educational productivity. In F. H. Farley & N. Gordon (Eds.), Psychology and education. Berkeley, CA: McCutchan.

Walberg, H. J. (1984). Improving the productivity of America's schools. Educational Leadership, 41(8), 19-30.

Walberg, H. J., Schiller, D., & Haertel, G. D. (1979). The quiet revolution in educational research. Phi Delta Kappan, 61, 179-183.

Walberg, H. J., & Shanahan, T. (1983). High school effects on individual students. Educational Researcher, 12(7), 7-12.

Wiley, D. E. (1984, April). Policy control of school time: Raising achievement. In E. B. Page (Chair), How much can research improve the schools? Hypothesis and findings for "A Nation at Risk." Symposium at the annual meeting of the American Educational Research Association, New Orleans.

Wiley, D. E., & Harnischfeger, A. (1974). Explosion of a myth: Quantity of schooling and exposure to instruction, major educational vehicles. Educational Researcher, 3, 7-12.

Table 1

Direct, Indirect, and Total Effects of Intellectual Ability, Quality of Instruction, Academic Motivation, Quantity of Academic Coursework, and Homework on High School Achievement

	Effects		
Variable	Direct	Indirect	Total
Ability	.499	.148	.647
Quality	.036	.046	.082
Motivation	.011	.089	.100
Coursework	.298	.015	.313
Homework	.050	-	.050

Table 2

Direct, Indirect, and Total Effects of Intellectual Ability, Quality of Instruction, Academic Motivation, Quantity of Academic Coursework, and Homework on High School Grades

	Effects		
Variable	Direct	Indirect	Total
Ability	.232	.180	.412
Quality	.027	.090	.118
Motivation	.185	.083	.269
Coursework	.285	.011	.296
Homework	.038	--	.038

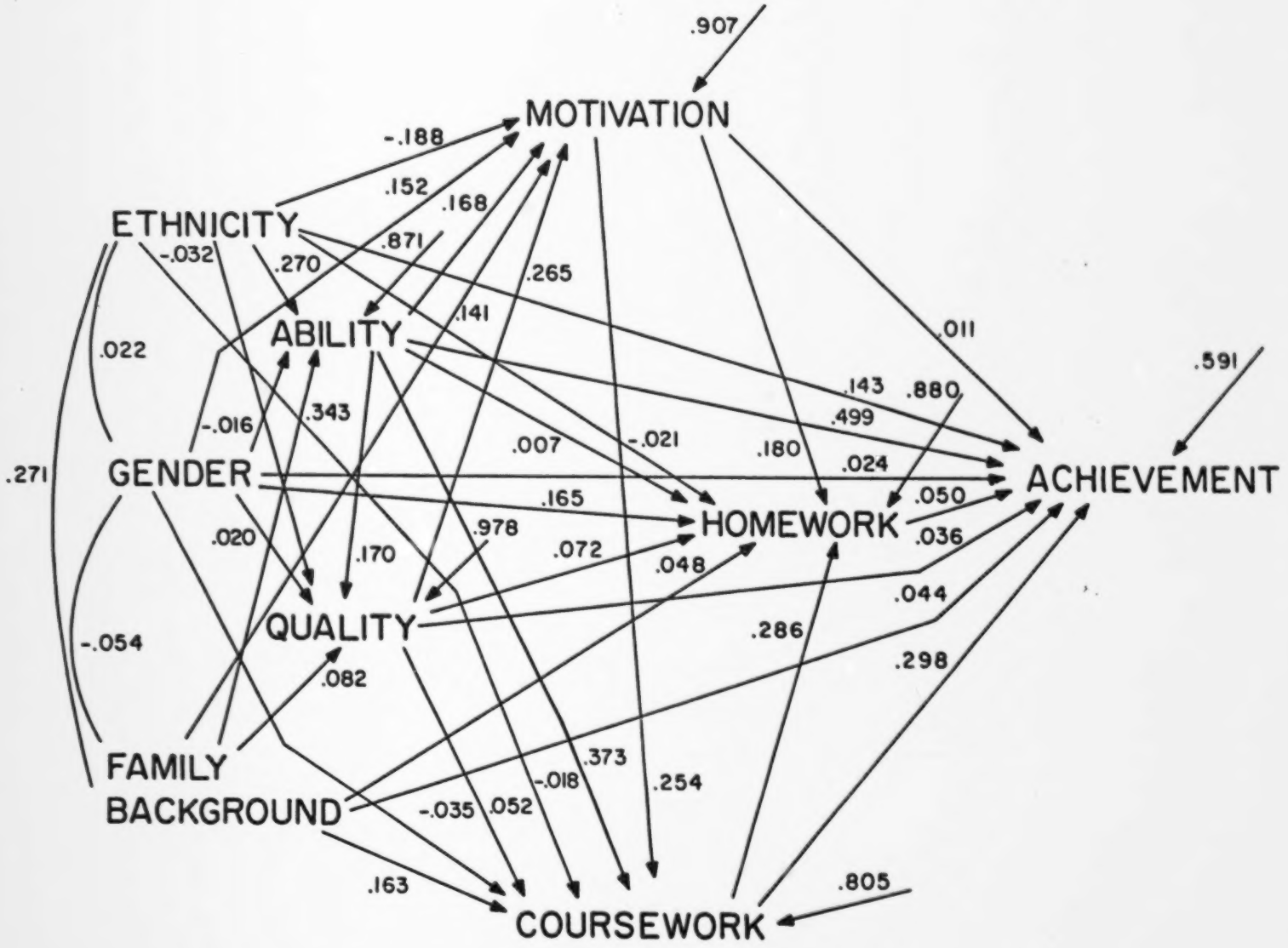

Figure 1. Effects of Background Variables, Intellectual Ability, Quality of Instruction, Academic Motivation, Academic Coursework, and Homework Time on High School Achievement Test Scores.

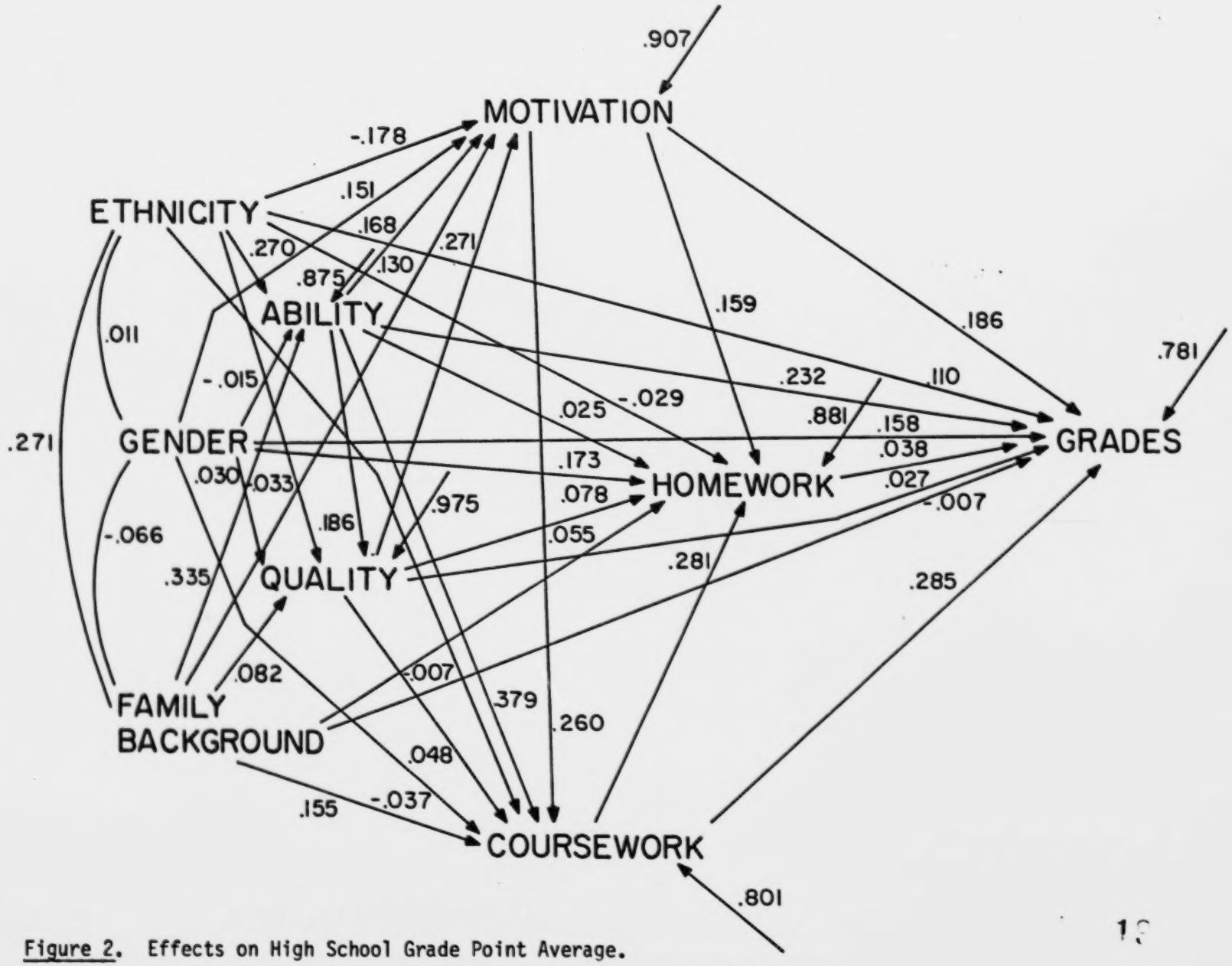

Figure 2. Effects on High School Grade Point Average.